

# Migration Status and Severity of Autism Spectrum Disorder: A Retrospective Study at Two Specialist Centers in Northern Italy

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## Abstract

**Background and Aim:** Migration has emerged as an environmental factor potentially contributing to the development of autism spectrum disorder (ASD). However, relatively little is known about the relationship between migration status and ASD severity. **Materials and Methods:** We retrospectively reviewed the geographical area of origin of 184 children with ASD (138 males, 75.0%) at two specialist centers in Northern Italy to assess possible correlations between migration status and ASD severity. **Results:** Based on migration status, 99 patients were classed as immigrant (74 males, 74.7%) and 85 as nonimmigrant (64 males, 75.3%). The severity of ASD was significantly higher in the immigrant group compared to the nonimmigrant group ( $\chi^2 = 16.32$ ;  $P < 0.001$ ). Specifically, ASD severity was significantly higher in patients migrating from Asia ( $\chi^2 = 10.85$ ;  $P = 0.004$ ) and Africa ( $\chi^2 = 6.26$ ;  $P = 0.044$ ), but not from South America ( $\chi^2 = 2.75$ ;  $P = 0.253$ ) or from Eastern Europe ( $\chi^2 = 2.76$ ;  $P = 0.252$ ). **Conclusion:** Immigrant patients have an increased risk of developing more severe ASD compared to nonimmigrants. Migration-related maternal stress has been proposed as an environmental factor possibly contributing to the development of more severe ASD. Linguistic and/or sociocultural proximity have been hypothesized to account for the lower severity of ASD in Hispanic immigrants from South America and Eastern-European White immigrants, compared to immigrants from Asia and Africa.

**Keywords:** Autism spectrum disorder, migration, risk factors, severity

## INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder with an average worldwide prevalence of 65 cases per 10,000 individuals.<sup>[1]</sup> Over the last few years, there has been a progressive increase in the number of children diagnosed with ASD, at least partially related to significant improvements in case identification and early diagnosis.<sup>[2]</sup> Despite the pressing public health concern, the multifactorial etiology of ASD has not yet been fully elucidated. Etiological mechanisms are thought to involve complex interactions between multiple genetic and environmental factors, which have been the subject of a considerable amount of research effort.<sup>[3]</sup>

Over time, migration has emerged as an environmental factor potentially contributing to the development of ASD.<sup>[4]</sup>

Immigrants represent an important population to study in this context, as parents from different regions may have varying genetic risks and different levels of exposure to environmental risk factors before or after immigration.<sup>[5]</sup> In addition, the investigation of the possible role of migration as a stress-inducing risk factor for the development of ASD can offer valuable insights into its etiology and help address preventable health disparities. We therefore set out to

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investigate the relationship between migration status and ASD. Specifically, we retrospectively reviewed the geographical area of origin of children with ASD at two specialist centers in Northern Italy, with the aim of assessing possible correlations with the severity of ASD.

## MATERIALS AND METHODS

As part of a clinical audit, we retrospectively reviewed the medical records of immigrant and nonimmigrant patients who had their first evaluation for suspected ASD at the Child and Adolescent Neuropsychiatry Units in Northern Italy (“Papa Giovanni XXIII” in Bergamo and “San Gerardo dei Tintori” in Monza) between January 2018 and December 2022. Both specialist clinics are located in Lombardy, the Italian region with the highest number of immigrants. We included in our analysis anonymized data from patients aged between 12 and 72 months, with a confirmed diagnosis of ASD (F84.0), including severity level according to Diagnostic and Statistical Manual of mental disorders (DSM-5-TR) specifiers. Specifically, the severity of ASD was rated as follows: level 1-lower ASD severity, requiring support; level 2-moderate ASD severity, requiring substantial support; and level 3-higher ASD severity, requiring very substantial support. Patients who fulfilled the diagnostic criteria for Other Pervasive Developmental Disorders (F84.8) or Pervasive Developmental Disorder, Unspecified (F84.9), as well as patients with incomplete data, were excluded from our analysis.

In addition to diagnosis and severity level, the following variables were systematically collected: Sex at birth, age at the time of assessment, place of birth, migration status, and geographical area of origin. Both patients born in Italy from parents of non-Italian origins who had previously migrated to Italy and patients born outside Italy from parents of non-Italian origins who had subsequently migrated to Italy were classed as immigrant.

This study was conducted as part of a clinical audit (retrospective chart review using an anonymized dataset) not requiring approval from an ethics committee. Statistical analyses were carried out with IBM SPSS Statistics v26. Differences in frequencies were assessed using the Chi-square test (dichotomous variables) and the Mann–Whitney *U*-test (ordinal variables). One-way ANOVA tests were used to assess the effect of geographical area of origin on the severity of ASD.

## RESULTS

We initially identified 253 patients with a confirmed diagnosis of ASD. Of these, 25 were excluded as they fulfilled the diagnostic criteria for Other Pervasive Developmental Disorders (F84.8) or Pervasive Developmental Disorder, Unspecified (F84.9). A further 44 patients were excluded because of incomplete documentation. As a result, data from a total of 184 patients (138 males, 75.0%) were included in our analysis. In terms of symptom severity, the clinical sample included 27 (14.7%) patients with level 1 ASD, 81 (44.0%)

patients with level 2 ASD, and 76 (41.3%) patients with level 3 ASD. Within the entire population, there were no statistically significant differences in ASD severity between males and females ( $z = 0.10$ ;  $P = 0.920$ ).

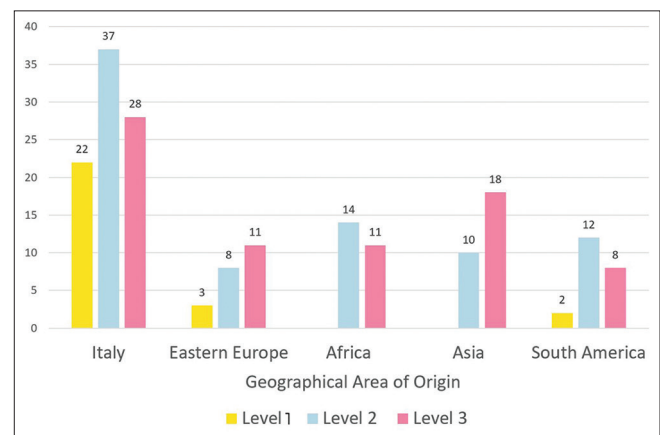
With regard to migration status, 99 patients were classed as immigrant (74 males, 74.7%) and 85 as nonimmigrant (64 males, 75.3%). Among immigrants, 5 (5.1%) patients were diagnosed with level 1 ASD, 46 (46.5%) with level 2 ASD, and 48 (48.5%) with level 3 ASD. Among nonimmigrants, 22 (25.9%) patients received a diagnosis of level 1 ASD, 35 (41.2%) of level 2 ASD, and 28 (32.9%) of level 3 ASD. The severity of ASD was significantly higher in the immigrant group compared to the nonimmigrant group ( $\chi^2 = 16.32$ ;  $P < 0.001$ ). There were no statistically significant differences in ASD severity between males and females across both the immigrant group ( $z = 1.50$ ;  $P = 0.134$ ) and the nonimmigrant group ( $z = 1.34$ ;  $P = 0.180$ ).

The geographical distribution of the immigrants was as follows: 28 patients from Asia, 25 from Africa, 22 from South America, and 22 from Eastern Europe. Two patients had complete data, but their geographical origin was not specified. The distribution of ASD severity levels by geographical area of origin of the patients is shown in Figure 1.

One-way ANOVA confirmed the effect of geographical area of origin of the patients on the severity of ASD ( $F = 6.69$ ;  $P = 0.002$ ). Compared to the nonimmigrant group, ASD severity was significantly higher in patients from Asia ( $\chi^2 = 10.85$ ;  $P = 0.004$ ) and Africa ( $\chi^2 = 6.26$ ;  $P = 0.044$ ). There were no differences in ASD severity between nonimmigrants and patients from South America ( $\chi^2 = 2.75$ ;  $P = 0.253$ ) or from Eastern Europe ( $\chi^2 = 2.76$ ;  $P = 0.252$ ).

## DISCUSSION

We assessed the relationship between migration status and ASD by retrospectively reviewing the geographical area of origin of children with ASD at two specialist centers in Northern Italy.



**Figure 1:** Distribution of autism spectrum disorder severity levels (level 1, low; level 2, moderate; and level 3, high) by geographical area of origin of the clinical sample ( $n = 184$ )

Our data showed that immigrant patients have an increased risk of developing more severe ASD compared to nonimmigrants. These findings applied to both male and female patients. Moreover, in evaluating the possible impact of the geographical area of origin of immigrants on the severity of ASD, we found that immigrants of Asian and African origins had a significantly higher risk of developing severe ASD compared to immigrants from South America and Eastern Europe.

Our findings are in line with previous studies suggesting that children of immigrant parents face a heightened risk of experiencing more severe ASD.<sup>[6]</sup> Across different studies, disease severity was rated according to clinical phenotypes, specifiers of DSM-IV diagnostic criteria, or presence of concomitant neurodevelopmental conditions such as intellectual disability.<sup>[3,7,8]</sup>

Several theories have been proposed to account for the correlation between migration status and severity of ASD. In addition to genetic factors, vitamin D insufficiency, which is more frequently observed in darker-skinned people, has been associated with higher rates and severity of ASD in immigrants.<sup>[4,9]</sup> Some authors have proposed that the migration process and associated maternal stress could play a role in the development of severe ASD in immigrants.<sup>[10]</sup> Specifically, it has been shown that maternal stress may induce epigenetic changes during pregnancy and delivery, and therefore possibly increase the risk of ASD and its severity.<sup>[10,11]</sup>

Our analysis of geographical areas of origin confirmed that ASD severity is significantly higher in patients from Asia and Africa compared to nonimmigrants.<sup>[3,5,7]</sup> Interestingly, we found that severity of ASD in South-American immigrants was not as high as that reported by African and Asian immigrants. It may be hypothesized that the shared Romance roots between Italian and Spanish/Portuguese languages might have facilitated integration of South-American immigrants in Italy, therefore reducing levels of migration-related stress. Moreover, it has been proposed that Children of Hispanic migrant mothers represent an exception to the maternal stress theory: nurturing socioeconomic conditions may play a protective role against the development of ASD in children of migrant mothers from closely connected Hispanic communities (so-called “Hispanic paradox”).<sup>[11]</sup> The lower severity of ASD observed in Eastern-European immigrants in our study is consistent with the findings of a recent study, where significantly lower degrees of perceived migration-associated stress were reported by White immigrants compared to other ethnic groups.<sup>[12]</sup> Finally, the increased risk of developing more severe ASD in the overall immigrant group is likely to be related with the observation that immigrants access specialist assessment at a significantly earlier age compared to nonimmigrants.<sup>[13]</sup>

It is important to consider a number of limitations when interpreting the findings of this study. Firstly, we acknowledge the limited sample size of this study, especially with regard to the female population. Secondly, the study was conducted in specialist clinics, thus limiting the generalizability of

our findings. Thirdly, this research primarily relied on a retrospective review of medical records, limiting the range of variables that could be examined as predictors of the severity of ASD. These include, but are not limited to, paternal parental age and education, birth weight, and gestational age, which were not specifically addressed in our study. The reason for embarking on the immigration process is a further example of a potentially relevant piece of information that was not available in the medical records.

## CONCLUSION

Our retrospective study showed that patients with ASD from families who relocated to Northern Italy have an increased risk of developing more severe clinical presentations compared to nonimmigrants. Migration-related maternal stress is an environmental factor possibly contributing to the development of more severe ASD. Moreover, linguistic and/or sociocultural proximity could account for the lower severity of ASD in Hispanic immigrants from South America and Eastern-European White immigrants, compared to immigrants from Asia and Africa. Future studies are needed to shed further light into the intricate relationship between migration status and the severity of ASD. Observing larger immigrant populations, incorporating a more comprehensive range of factors and implementing prospective data collection methods would be beneficial to validate the results of the present study and to explore alternative hypotheses for the higher severity of ASD in selected immigrants.

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## Conflicts of interest

There are no conflicts of interest.

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